

# PATENT SPECIFICATION

1,075,115



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Date of Application and filing Complete  
Specification: December 19, 1963.

No. 50138/63

Application made in Japan (No. 15684) on March 28, 1963.

Complete Specification Published: July 12, 1967.

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Index at Acceptance:—D1 K (24A9, 247, 251, 422, 454, 541, 55Y, 551, 558, 563, 565, 677, 68Y, 690, 70Y, 722); D1 S (4, 6, 18); D1 W (7A, 7C).

Int. Cl.:—D 03 d, D 04 b // D01h, D06h.

## COMPLETE SPECIFICATION

### NO DRAWINGS

#### Method of Manufacturing Knitted and Woven Elastic Fabrics

We, KURASHIKI RAYON KABUSHIKI KAISHA of No. 1621, Sakazu, Kurashiki City, Japan, a company organized according to the laws of Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method of which it is to be performed, to be particularly described in and by the following statements:—

- 10 This invention relates to an improvement in the method of manufacturing knitted and woven elastic fabrics consisting of highly elastic yarns such as yarns of polyurethane, natural rubber, or synthetic rubber.
- 15 In the heretofore known method of manufacturing knitted goods or woven fabrics by using elastic yarns, the yarns were set by using a setting agent and the yarns thus set were used to manufacture knitted goods
- 20 or woven fabric, then the fabric was treated with a suitable treating agent to remove the setting agent, thereby restoring the initial elasticity. In another method yarns were knitted or woven in a stretched condition.
- 25 According to such a method there remains substantial stretch in the elastic yarns of the knitted goods or woven fabrics so that not all of the elasticity inherent in the elastic yarn is available in the elastic fabrics.
- 30 The invention relates to a method of manufacturing elastic knitted goods or woven fabrics wherein yarns of polyurethane, natural rubber or synthetic rubber having high elasticity, and water soluble
- 35 yarns of polyvinyl alcohol are twisted together and the twisted yarns are used, in that state, or the twisted yarns are shrunk in a solvent mainly consisting of water or water vapour to provide shrunk yarns which
- 40 are used to make the knitted or woven fabrics, or the twisted yarns are used to make the knitted or woven fabrics of large meshes and the fabric is shrunk by means

of a solvent mainly consisting of water or water vapour; and subsequently in any of the above cases the fabric is dipped into a solvent mainly consisting of water to dissolve and remove the polyvinyl alcohol yarns and the elastic yarns are retained.

The elastic yarns used in the invention are yarns made from polyurethane, synthetic rubber or natural rubber, and the yarn may be twisted or not and also may be monofilament or multifilament or spun yarn of elastic fibres, or yarns consisting of elastic yarns covered with non-elastic fibres or yarns.

The water soluble yarn, that is, the yarn to be dissolved in water is made from polyvinyl alcohol and a polyvinyl alcohol is chosen which can dissolve in cool water, warm water, hot water or hot water at a temperature higher than 100°C, according to requirements.

Polyvinyl alcohol yarns immediately after spinning as well as after heat treatment can be used.

Further, partially saponified and completely saponified polyvinyl alcohol can be used and polyvinyl alcohol having a degree 70 of polymerization of 500 to 3,000 is most suitable.

According to the invention, it is necessary to twist together elastic yarns and water soluble yarns and the direction of twisting may be either clockwise or counter-clockwise.

The yarns are mechanically twisted together but they are not adhered together.

According to the invention, the elastic yarns do not need to be crimped so that it is not necessary to twist-set by heat setting the twisted yarns.

The twisting is not limited to any particular method but it is generally preferable to wind the elastic yarns around a core of

[Price 4s. 6d.]

water soluble yarns. So-called corkscrewed yarn and spiral yarn are preferable.

The number of twists in the twisted yarn may be 5-3,000 T/m, preferably 60-1,000 T/m. According to the invention, the twisted yarns and the water soluble yarns are twisted in an opposite direction to twisting of said elastic fibres.

Such twisted yarns have good stability in shape with respect to elongation and contraction so that it is very easy to knit or weave them.

According to the invention, the twisted yarn consisting of elastic yarns and water soluble yarns can be used as they were twisted to manufacture knitted goods and woven fabrics; alternatively shrunk yarns made by shrinking the twisted yarns in a solvent mainly consisting of water or water vapour while not dissolving the water-soluble yarns can be used for the production of knitted goods or woven fabrics; and moreover the twisted yarns without being shrunk can be used to knit or weave a fabric having large meshes and the knitted goods or woven fabrics may be shrunk in a solvent mainly consisting of water or water vapour while not dissolving the water-soluble yarns. It is sometimes more convenient to effect the shrinking in water at a comparatively low temperature containing an auxiliary solvent and to effect the subsequent dissolving of the water-soluble yarns in water at comparatively high temperature not containing an auxiliary solvent.

By dissolving and removing the water soluble yarns in this manner there remain knitted goods or woven fabrics consisting of elastic yarns of polyurethane, natural rubber or synthetic rubber and the like.

These fabrics have very high elongation and contraction and are very suitable for the manufacture of foundation garments, such as panties, slips, corsets, girdles, brasieres, and garters, various kinds of sporting wear, belts, caps, bandages, diving wear, protective coats, protective masks, tennis balls, socks, shoe materials, mattress covers, washing bags, and table cloths.

When fabrics are made the twisted yarns may be used for either warp or for both and in case of knitted goods there is often no reason to include other yarns besides the twisted yarns of the invention although this will depend on the method of knitting.

#### Example 1

Polyvinyl alcohol filament yarns (45 denier), soluble in warm water and made by spinning polyvinyl alcohol having average degree of polymerization of 1,700 and saponification degree of 88% by a conventional process, and elastic polyurethane filament yarns (140 denier) were twisted together by clockwise rotation at a rate of 800 T/m. to provide the twisted yarns for knitting, and

two sided knitted goods were made by using the twisted yarns, then the knitted goods were plunged into hot water previously heated to 90°C and the water was agitated to dissolve and remove the water soluble polyvinyl alcohol yarns. The knitted goods thus obtained consisting of polyurethane fibres only had good elongation and contraction properties.

#### Example 2

Polyvinyl alcohol filament yarns (45 denier) which are insoluble in warm water but soluble in hot water obtained by spinning polyvinyl alcohol having average degree of polymerization of 2,000 and saponification degree of 95% by a conventional process and heat treated at 225°C for 5 minutes, and elastic polyurethane filament yarns (280 denier), were twisted together clockwise at a rate of 500 T/m. and the twisted yarns were dipped into an aqueous solution containing 10% magnesium chloride heated to 50°C to shrink the thread by about 20% and provide the twisted yarns for weaving.

By using the twisted yarns "French Twill" weave structure having warp density of 120/inch and weft density of 60/inch was made. The fabric thus woven was washed in boiling water for 30 minutes and the water soluble polyvinyl alcohol fibres were thus dissolved in the boiling water and removed.

After drying the remaining fabric in a dryer at 90°C for 3 minutes a soft textile fabric having excellent elasticity in warp and weft directions was obtained.

#### Example 3

Elastic polyurethane fibres (420 denier, 750% elongation) were elongated 5 times, covered with under-wrapping cotton yarn (6,000 r.p.m.) and upper-wrapping cotton yarn (4,500 r.p.m.) and taken up at a rate of 2 m./min. Polyvinyl alcohol filaments (45 denier) which are insoluble in warm water but soluble in hot water, obtained by spinning polyvinyl alcohol having average degree of polymerization of 2,000 and saponification degree of 95% by a conventional process and heat treating at 220°C for 5 minutes, and the above elastic polyurethane yarns were twisted together clockwise at a rate of 800 T/m. to provide the twisted yarns for weaving. By using the above twisted yarns as warp and cellulose acetate fibres as weft, a plain weave structure having weft density of 60/inch and warp density of 80/inch was made. The fabric thus woven was plunged into hot water previously heated to 95°C and the water soluble polyvinyl alcohol filaments were thus dissolved and removed. The fabric obtained consisting of polyurethane yarns covered with cotton and cellulose acetate yarns had excellent elasticity in the warp direction.

#### WHAT WE CLAIM IS:—

1. A method of manufacturing knitted

and woven elastic fabrics wherein yarns of polyurethane, natural rubber, or synthetic rubber, having high elasticity, and water soluble yarns of polyvinyl alcohol are twisted together and the twisted yarn thus obtained is used to make a knitted or woven fabric and the fabric thus obtained is dipped into a solvent mainly consisting of water to dissolve and remove the polyvinyl alcohol yarns, thereby leaving a fabric formed of the elastic yarns.

2. A method according to claim 1 wherein the twisted yarns are shrunk in a solvent mainly consisting of water without dissolving the polyvinyl alcohol yarns and the shrunk twisted yarns are used to make the knitted or woven fabric.

3. A method according to claim 1 wherein the twisted yarns are used to make a

fabric having large meshes and the fabric is then shrunk and afterwards the shrunk fabric is dipped into a solvent mainly consisting of water to dissolve and remove the polyvinyl alcohol yarns.

4. A method according to any of the preceding claims wherein the elastic yarns and the water soluble yarns are twisted together by winding the elastic yarns around a core of the water soluble yarns.

5. A method of manufacturing knitted and woven elastic fabrics substantially as described herein in any one of the Examples.

6. A knitted or woven elastic fabric manufactured by a method according to any of the preceding claims.

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